

DIRECTIONS

for using the

RADIATION DOSAGE CALCULATOR

RADIATION HAZARD

In the explosion of an atomic bomb a quantity of radioactive material is produced. This material, called fission products, will normally be dispersed in the upper atmosphere following an air burst and will constitute no hazard to persons on the ground. However, should a bomb be exploded near or under ground or water, large amounts of dust or spray may be thrown up. As this dust or spray settles to earth it may carry with it radioactive fission products from the atomic cloud. These would constitute a radiation hazard.

PURPOSE OF CALCULATOR

The radioactivity is greatest at the time of the explosion and decreases thereafter, first rapidly and then more slowly with time. Thus the radiation dosage rate in a contaminated area is always changing. Once a measurement of the dosage rate is made at any single time, the dosage rate at any future time or any past time may be calculated with one setting of the calculator.

The total dose of radiation which one receives by staying in a contaminated area depends on the length of time spent, the dosage rate existing, and the rate at which the dosage rate is changing in the area. The calculation involving all of these factors is accomplished by a single additional setting of the calculator.

OPERATION OF CALCULATOR

Most meters which measure radiation give a reading of dosage rate in milliroentgens per hour, mr/hr. One thousand milliroentgens equals one roentgen.

When a measurement is made, a meter-reading in units of mr/hr is obtained. Next, locate the position of this number on the outermost scale of the calculator. (Note that thousands are designated by the letter K, thus 5000 mr/hr appears as "5K", etc.). The time of making the reading is the time that has elapsed since the explosion. Turn the larger dial until this time appears next to the observed meter reading. Holding the dial fixed in this position locate any past or future time on the same scale and find the dosage rate at that time next to it on the outermost scale. (Note that the time scale increases from right to left, in a counterclockwise direction).

To calculate the total dose of radiation accumulated by remaining in a contaminated area for a particular period of time,

begin by setting the time of making a reading next to the meter-reading observed. Do this exactly as described above, using the outer two scales. Holding the large dial fixed in this position, locate the time of entering the contaminated area on the innermost scale and turn the small dial until this time appears next to the arrow marked "START EXPOSURE". (Note that all times are measured from the time of the explosion). Any later time may now be located on the innermost scale, and to find the dose accumulated by remaining in the area up to that time follow the guide lines out to the edge of the large dial and read the answer in milliroentgens on the outermost dial.

ILLUSTRATIVE
EXAMPLE

Suppose that at 1 hour after the explosion a meter-reading of 2000 mr/hr is observed in a contaminated area. Locate "1 hr" on the edge of the large dial and set it next to "2K" on the outermost scale. To find the dosage rate expected in the area three hours after the explosion find "3" to the left of "1 hr" and read on the outermost scale a dosage rate of 550 mr/hr.

Hold the outer dial fixed in this position. Suppose that a man has been in this area since 30 minutes after the explosion. Turn the small dial until "30" is next to the arrow marked "START EXPOSURE". To find the dose he has accumulated up to the present time (one hour after the explosion) locate "1 hr" on the innermost scale, reading approximately 1.5K by following the guide lines to the outermost scale. His dose is therefore 1500 mr, or 1.5 r.

To find how long the man can remain in the area before his total accumulated dose exceeds, say, 5 roentgens (5000 mr), locate "5K" on the outermost scale and follow the guide lines to the innermost scale, estimating between guide lines a reading of about 8 or 9 hours. Thus, by remaining until 8 or 9 hours after the explosion, the man will accumulate a total dose of 5 roentgens.

SPECIAL
REMARKS

The outermost scale has no designation printed on it to indicate the units used. This is for two reasons. First, this scale is used to give both dosage rate in mr/hr, and also total accumulated dose in mr. To print both designations might lead to unnecessary confusion. Second, if unusually high levels of radiation are encountered, it may prove convenient to discard the milliroentgen and use the roentgen as the basic unit in calculations. In this case, values on the outermost scale may be interpreted in r/hr for dosage rates, and r for cumulative doses.

In certain relatively unlikely calculations one or another of the scales may not be long enough to include the desired solution, and an erroneous answer may even be indicated if overlapping occurs with the opposite end of the scale. No misuse of the calculator

need be anticipated, however, since the false answer will be so impossibly large or small as to attract attention at once.

The innermost time scale begins at 15 minutes after the explosion, meaning that cumulative doses cannot be calculated if exposure starts earlier than this. From the practical standpoint it seems unlikely that anyone approaching the disaster area from outside will be able to penetrate to a dangerously contaminated area in any shorter time. On the other hand, survivors caught in the area at the time of the explosion will probably receive a large dose of radiation from the initial burst, invalidating any calculation based solely on residual radioactivity.

Finally, it should be apparent that for relatively short intervals spent in a contaminated area, e.g., an interval of 2 hours at 4 days after the explosion, one may consider the dosage rate to be essentially constant. If the dosage rate were 15 mr/hr, then two hours' exposure would give a dose of 30 mr. This approximate calculation is satisfactory whenever the normal method of using the calculator requires using guide lines inconveniently close to the "START EXPOSURE" arrow.

HOW TO
PURCHASE

The Radiation Dosage Calculator, designed for the Connecticut State Office of Civil Defense by members of the staff of the University of Connecticut, is now offered for sale to other interested organizations and individuals. Price, one dollar. Discount on large orders.

Address: Radiation Calculator
 P. O. Box 27
 Storrs, Connecticut

RADIATION DOSAGE CALCULATOR

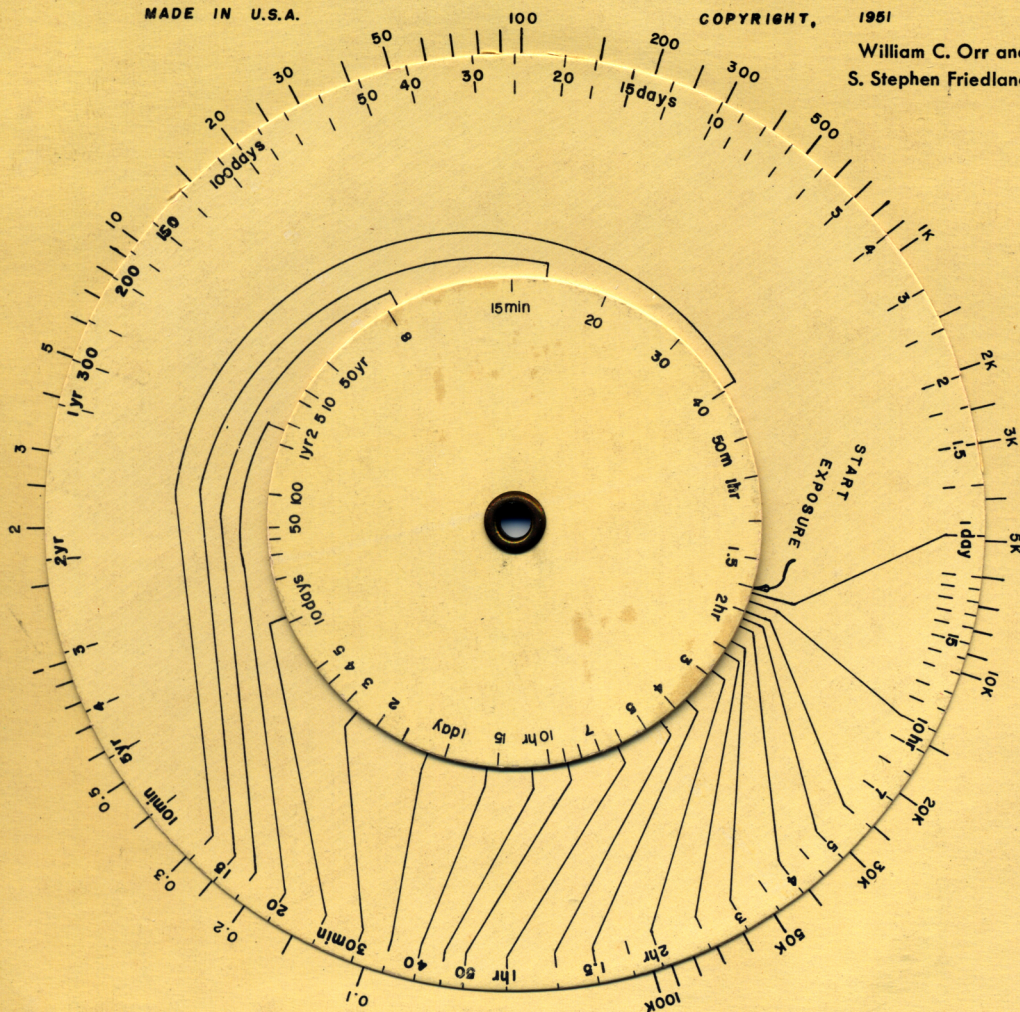
for

FISSION PRODUCT RADIATIONS

MADE IN U.S.A.

COPYRIGHT, 1951

William C. Orr and
S. Stephen Friedland



All times are measured from the time of the explosion.

DOSAGE RATE AT ANY TIME:

Set time of reading against dosage rate in mr/hr using two outer scales. Dosage rates at earlier or later times appear in mr/hr on outer scale next to corresponding time.

TOTAL DOSE RECEIVED DURING ANY INTERVAL:

Set time of reading against dosage rate as described above. Set time of entry into contaminated area (innermost scale) against arrow marked "Start Exposure." Dose accumulated up to any later time (innermost scale) appears in milliroentgens on outer scale.